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Determination of Impact Sensitivity of Materials at High Pressures

The problem:

The major systems that are currently being used to perform mechanical impact testing have a number of disadvantages including the following:

1. The large volume of liquid oxygen required in the operation of these systems makes them a potential source of dangerous explosions.
2. Tests are difficult to duplicate.
3. They are slow and limited to a few tests per day.
4. Because of the weight of the system, a hoist is required to lower and raise the test sample.

Systems designed to overcome these difficulties are limited to a 1.04×10^7 N/m^2 (1500 psia) pressure and cannot measure the force imparted to the test sample.

The solution:

A new, compact device can determine the impact sensitivity of a material in a static, high-pressure, gaseous environment [up to 6.9×10^7 N/m^2 (10^4 psia)]. It overcomes the disadvantages of the prior devices, and can be instrumented to monitor and record pressure, temperature, and the striker impact force.

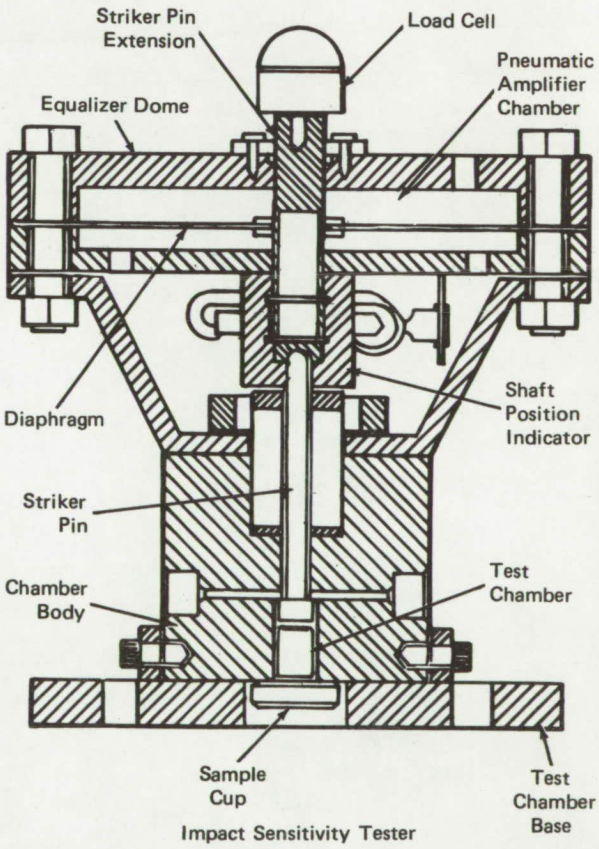
How it's done:

This device (see figure) is used in conjunction with a commercially available liquid-oxygen (LOX) impact tester which provides the impact energy. The plummet of the LOX tester (not shown) is raised to the desired height and held there by an electro-magnet assembly. The test sample is placed in the sample holder shown in the figure, and the test chamber is pressurized to the required test pressure. Next, the striker-pin force is neutralized by pressurized nitrogen fed into the pneumatic amplifier chamber.

When all the pressures are adjusted, the electromagnet releases the plummet which strikes the load cell and the striker pin, driving the pin against the sample. Recordings are made of the pressure, temperature, impact force, and the plummet drop time. An oscilloscope attached to the load cell displays the force per unit time (energy) imparted to the striker pin.

An interesting feature of this system is the pneumatic amplifier which increases the striker driving force to compensate for the retarding effect of the difference in pressure between the test chamber and the atmosphere.

A second prototype uses a load cell under the sample cup to measure both the static force prior to impact and the impact force.



Impact Sensitivity Tester

(continued overleaf)

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Note:

Requests for further information may be directed to:

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Patent status:

NASA has decided not to apply for a patent.

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